SCIENTIFIC PAPER

Saving Time During Laparoscopy Using a New, Wall Anchoring Trocar Device

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ABSTRACT

Objective: Safe and reliable access systems are crucial in laparoscopy, and trocar dislodgement is still a common and frustrating problem. Wall emphysema can occur besides the risky prolongation of the surgical procedure. Wall-anchoring components provide a better hold of the device. This comparative analysis assesses the frequency of dislodgement and a time-sparing effect on the intervention of 3 different trocar systems, including an innovation in the field of access-providing systems.

Methods: Patients who underwent laparoscopy for various gynecological indications were included and randomized consecutively into 3 groups according to the access system used in the intervention: (A) trocar fitted with a spiral thread on the sleeve, (B) trocar with plain sleeve, (C) trocar as in B together with a fixator. This novelty is installed on the trocar before insertion and then sutured to the abdominal wall. Intervention time, frequency of trocar corrections, and the time loss through correction were registered. Standard statistical analyses were performed.

Results: The cohort comprised 131 patients; 51 patients were consecutively randomized into group A, 38 into group B, and 42 into group C. Mean intervention time was different, shortest in C and highest in B. Frequency of interruption of the intervention due to adjustment of the device and time loss through adjustment was lowest in group C (fixator + plain sleeve) and highest in group B (plain-sleeve) (0.47 vs 0.29, $P<0.05$ and 2.13 minutes vs 0.69 minutes, $P<0.05$).

Conclusion: Wall-anchoring components lead to higher stability of ports and have a time-sparing effect. Comparing the 2 trocar groups with wall-anchoring properties (trocar with thread-fitted sleeve vs fixator + trocar with plain sleeve), the mean operation time was lowest in the fixator group, and the time-saving effect was higher.

Key Words: Laparoscopy, Trocar, Dislodgement.

INTRODUCTION

This study addressed the timesaving effect of different trocar systems in gynecological laparoscopic interventions. The dislodgment of trocars is a known problem and can lead to frequent interruption of an endoscopic intervention and to its prolongation.

Laparoscopic access systems have 2 components: an outer sleeve or port and removable inner trocar used to facilitate insertion. The port remains in place to allow insufflation and passage of instruments. Regarding their mode of insertion, the variety of available laparoscopic access systems can be classified into 2 categories: bluntly dilating-tip-trocars and cutting bladed-tip-trocars. Bladed-tip-trocars incorporate a sharp plastic or metal blade that cuts through tissue layers as force is applied. Dilating-tip-trocars bluntly separate and dilate tissue as force is applied. The insertion of the trocar has to be easy, and nontraumatic to the underlying viscera; the defect size should be as minimal as possible. Dilating-tip-trocars are designed to minimize the complications associated with the insertion of the device into the abdominal wall, and they seem to have favorable effects on vascular and visceral injury, abdominal wall hematoma, or trocar-site-pain compared with cutting-trocar systems.[1–4] Dilating-tip trocars and bladed-tip trocars have been compared before, addressing the question of injury of viscera.[5] Management of trocar-site hernia is another aspect of the various approaches that are made to optimize the attributes of trocar systems.[4,6]

For preventing the dislodgement of the port, attempts are made by giving more structure to the port's surface, like a

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DOI: 10.4293/108680810X12785289144034

spiral thread for screwing the port into the abdominal wall, or by sewing the device directly onto the abdominal wall.[7]

Trocar designs have evolved in response to complication rates and surgical ergonomics. Displacement of surgical devices during laparoscopy can be more stressful for the operating surgeon than during open surgery due to impaired view and manual access to the operation field. The physical and visual interface has been shown to increase the workload of the surgeon.[8] The trocar as access-providing device has to fulfil the demands of easy and minimally traumatic handling, it has to remain reliably attached to the insertion site throughout manipulation with endoscopical instruments, and it has to maintain the valve function to preserve the insufflation of the abdomen. Regarding their dislodgement behavior, we evaluated 3 access systems in a comparative study: one dilating-tip (A): the sleeve of this trocar is fitted with a spiral-thread; one bladed-tip (B): common working trocar with a plain smooth sleeve; and third(C): an innovation in the field of access-providing systems, a trocar fixator that is used in combination with (B). The objective of this device is to prevent the trocar from overinsertion and secondly to stabilize it broadly based on the abdominal wall and by being sutured at 3 points over the insertion point. This combination of trocar properties is a novelty to the field of access systems. The aim of the study was to determine the trocar system with the most favorable dislodgement behaviour regarding the time-sparing effect. Tissue-anchoring components of ports trying to enhance the stability of the system in the abdominal wall throughout the intervention have not been investigated in a study before, though the necessity of a better stability of the port system has been a matter of consideration, and suturing the port to the abdominal wall with a single wall-anchoring suture and without additional devices has been previously described in a small series.[5]

MATERIALS AND METHODS

Access Systems

(A): 5-mm thread-fitted trocar. (Aesculap) bluntly dilating-tip. The sleeve is fitted with a spiral thread to screw the port in the abdominal wall and provide a better hold in the tissue. Defect size after removal ca. 7mm.

(B): 5-mm plain sleeve trocar. (Storz) bladed-trocar-tip. The trocar sleeve has a smooth surface. Defect size of ca. 5mm after removal.

(C): fixator plus 5-mm plain sleeve trocar. (Innovamed) bladed-tip trocar like in (B). The fixator is installed on the port before insertion. It consists of 3 parts: a triangular perforated plate of transparent plastic to hold the port. The port is fitted with a plastic nut. For a better fit of the nut, differently sized rubber rings are provided and inserted through the hole of the plate that has a connection-thread to screw the parts together. The nut on the trocar sleeve can be screwed to the plate with a corresponding screwing tool. The port is inserted as usual, and the plate is sutured at 3 points over the insertion point. The defect size is ca. 5mm after removal plus 3 suture marks.

Patients who were scheduled for gynecological laparoscopic interventions in the Pius Hospital Oldenburg, Germany between November 2006 and July 2007 were consecutively randomized into the trocar groups A-C after written, informed consent. For a subgroup analysis of the distribution of major or minor surgical intervention in the groups, the type of intervention was registered in the common manner into 2 groups: *minor* - adnexal interventions single or in combination with treatment of endometriosis, and/or adhesiolysis; *major* - interventions on the uterus, ie, laparoscopic-assisted supracervical hysterectomy and myomectomy. Each intervention was logged by a nurse, and time was measured with a stopwatch. Intervention time was measured from the moment of incision in the umbilical area until the last suture. All interventions were performed by the same surgeon. Two trocars of each type at a time were placed at conventional insertion sites for gynecological laparoscopic intervention in the lower abdomen; the optic-trocar was placed conventionally in the umbilical area and was not regarded in this study. All-over intervention time and the duration of interruption of the intervention for correction of the trocars were registered.

Statistical analysis was performed with SSPS 16. The overall difference between the groups was calculated with a multivariate analysis, and Pearson's correlation and regression analysis was used for calculating significances. $P<0.05$ was defined as significant.

RESULTS

See **Table 1** for details of the 3 groups. Included in this analysis were 131 patients; 51 consecutive patients were randomized into the group A (thread-fitted sleeve), 38 into group B (plain sleeve), and 42 into group C (fixator plus plain sleeve trocar). There was a significant overall difference in the parameters between the 3 groups. The mean

Table 1.
Results for Each Access System

	Grp A Thread-fitted Sleeve	Grp B Plain Sleeve	Grp C Fixator *Plus* Plain Sleeve
Mean operation time (*min*) *(range, 10 to 310)*	74.6	80.3	62.1 P<*0.05*
Mean no. of corrections *(range, 0 to 15)*	0.96	4.63 P<*0.05*	1.10
Mean time loss through correction (*min*)	0.69	2.13 *P<0.05*	0.69

intervention time was significantly different in the 3 groups, being shortest in group C with 62.1 minutes (fixator plus plain sleeve) and longest in the group B with 80.3 minutes (plain sleeve trocar). The frequency of corrections of the displaced device was significantly lower in group C (fixator + plain sleeve) and group A (thread-fitted sleeve) and highest in group B (plain sleeve trocar) (C: 1.1 resp. A: 0.96 vs. B: 4.63, P<0.05). The time loss through adjustment was significantly shorter in group C (fixator + plain sleeve trocar) and longest in group B (plain sleeve trocar) with 2.13 minutes vs 0.69 minutes (P<0.05). In these 2 parameters, there was no significant difference between group A (thread-fitted trocar) and group C (fixator + plain sleeve trocar).

The subgroup analysis of the types of interventions revealed no significant difference in the distribution of major gynecological and minor gynecological interventions in the 3 groups.

There was a weak positive correlation between operation time and frequency of correction (r square 0.25), showing the prolongation of the surgical procedure through correcting of the device, overall and in the subgroups. The weakest correlation here was found in the thread-fitted-trocar group.

DISCUSSION

We can conclude from this comparative analysis of 3 different access systems that tissue- anchoring components lead to a higher stability of port systems and to a significant reduction in operation time due to a significant reduction in interruptions of the surgical intervention and less prolongation of the procedure. In all 3 systems, the correction of the port led to longer intervention time. But comparing the 2 trocar systems with tissue-anchoring properties, namely the thread-fitted trocar (A) and the fixator (C), mean operation time was significantly lower in the fixator group (C) and the time-saving effect higher.

The value of the fixator in avoiding major vessel injury can only be evaluated in very large series of patients, because the frequency of major vessel lesions is relatively low. Dislodgment of trocars is more likely to occur in obese patients.[5] The obesity state of the patients included in this study has not been assessed; in further comparative studies the obesity state of the patient should be registered, adjusting for this risk factor for trocar dislodgement. Furthermore the patients' response and acceptance of the additional suture marks that remain after the use of the fixator combination have not yet been investigated.

Desufflation of the abdomen and subcutaneous emphysema are some of the sequelae of dislodgement of port systems, besides the disadvantages due to prolongation of the surgical procedure. Since economical considerations in surgery typically comprise the minimization of intervention time, an evaluation of surgical devices regarding their time-sparing modifications could be useful for working endoscopic surgeons.

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